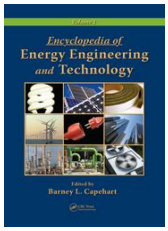
Encyclopedia of Energy Engineering and Technology



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Dr. Anwar recently edited *Nanotechnology for Telecommunications*, published by Taylor and Francis Group/CRC Press in June 2010. Moreover, he is co-editing a book, *Advanced Nanoelectronics and Graphene Nanoribbon Technology*, to be published by Taylor and Francis Group/CRC Press in 2012. He is also editing *Handbook of Research on Solar Energy Systems and Technologies*, to be published by IGI Global Press in 2012. He is the Editor-in-Chief of the *Encyclopedia of Energy Engineering & Technology*, published by Taylor and Francis Group.

Dr. Anwar is a Senior Member of IEEE, and a Member of ASEE, ATMAE, and PAS. He is currently serving as a member of the IEEE Committee on Technology Accreditation Activities (CTAA). In addition, he is an Alternate Commissioner of the Technology Accreditation Commission (TAC) of ABET.

Peer Review Board

Preface

Energy engineers and technologists have made efficient and cost effective devices for many years that provide the energy services that society wants and expects. From air conditioners

to waste fuels, energy engineers and technologists continue to make our lives comfortable and affordable using limited resources in efficient and renewable ways.

Over 300 researchers and practitioners, through 190 entries, provide ready access to the basic principles and applications of energy engineering, as well as advanced applications in the technologies of energy production and use. The global supply of energy is increasingly being stressed to provide for an expanding world population. Energy efficiency, energy conservation through energy management, and use of renewable energy sources are three of the major strategies that in the future will help provide the energy and energy services for the world's population and the world's economy.

This unique reference contains state of the art progress on the most important topics in this field of energy engineering and technology. All entries in the *Encyclopedia* have been written by experts in their specialties, and have been reviewed by subject matter authorities. This distinguished group of experts share a wealth of knowledge on topics such as:

- Energy, energy supplies and energy use
- Renewable and alternative energy sources
- Technical, economic and financial analysis of energy systems
- Energy uses in buildings and industry
- Energy efficiency and energy conservation opportunities and projects
- Commissioning, benchmarking, performance contracting, and Measurement and verification
- Environmental regulation and public policy for energy supply and use
- Global climate change and carbon control
- Sustainable buildings and green development
- Hybrid electric and hydrogen fueled vehicles and maglev transportation

The *Encyclopedia of Energy Engineering and Technology* is a key reference work for professionals in academia, business, industry and government, as well as students at all levels. It should be regularly consulted for basic and advanced information to guide students, scholars, practitioners, the public, and policy makers. Contributions address a wide spectrum of theoretical and applied topics, concepts, methodologies, strategies and possible solutions.

The Online Edition is a dynamic resource that will grow as time and knowledge progress. Suggestions for additional content are welcomed by the editor, and new authors should contact me at the email address listed below.

Preparation of this modern compendium on energy engineering and technology has only been possible through the commitment and hard work of hundreds of energy engineers from around the globe. I want to thank all of the authors for their outstanding efforts to identify major topics of interest for this project, and to write interesting and educational articles based on their areas of expertise. Many of the authors also served a dual function of both writing their own articles, and reviewing the submissions of other authors. Another important group of people were those on the Editorial Board who helped submit topics, organizational ideas, and lists of potential authors for the *Encyclopedia*. This Board was a great help in getting the actual writing of articles started, as well as many of the Editorial Board members also contributed articles themselves.

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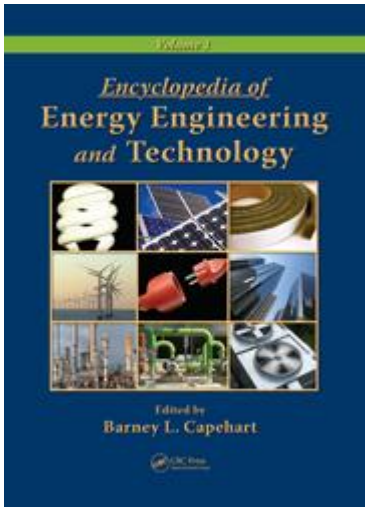

Life Cycle Energy and Carbon Footprint Assessments: Agricultural and Food Products

- **DOI:** 10.1081/E-EEE-120045699

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Abstract

This entry presents an overview of methods for calculating the life cycle energy and carbon footprints of different agricultural and food products. The direct energy input, indirect (embodied) energy use, and other associated greenhouse gas emissions from agriculture are evaluated.

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